REPORT DOCUMENTATION PAGE

Form Approved
OMB NO. 0704-0188

1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE 09/23/2000	3. REPORT TYPE AND DATES COVERED Final Progress Report 07/01/99-06/30/00

4. TITLE AND SUBTITLE
Matching pursuits & hidden Markov models for processing IR imagery

5. FUNDING NUMBERS
DAAD19-99-1-0256

6. AUTHOR(S)
Lawrence Carin

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Duke University
Department of Electrical and Computer Engineering
Durham, NC 27708-0291

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U. S. Army Research Office
P.O. Box 12211
Research Triangle Park, NC 27709-2211

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

ARO 40273.2-EL

11. SUPPLEMENTARY NOTES
The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other documentation.

12 a. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution unlimited.

12 b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

Infrared imagery from several military vehicles is considered, with the goal of classification. The IR imaging process effects a projection of a three-dimensional target onto a two-dimensional image.
The target-sensor orientation is uncertain, as is the target identity. There are contiguous sets of orientations for which the imagery is statistically stationary, with these termed states of the target. Each target has multiple states, and these can be employed in a Hidden Markov model for moving-target classification.
A set of expansion-matching (EXM) filters is constructed for the target parts, for a given target state.
The output of the EXM filters are processed in a tree-like fashion, via a Hidden Markov Tree.
Classification performance is assessed through consideration of multi-target IR imagery acquired from the US Army Night Vision and Electronic Systems Division (NVESD).

14. SUBJECT TERMS
matching pursuits, hidden Markov model

15. NUMBER OF PAGES
2

16. PRICE CODE

17. SECURITY CLASSIFICATION OR REPORT	18. SECURITY CLASSIFICATION ON THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

I. List of Manuscripts Submitted/Published under ARO Support

P. K. Bharadwaj, P.R. Runkle and L. Carin, "Target identification with wave-based matched pursuits and hidden Markov models," IEEE Trans. Antennas Propagat., vol. 47, Oct. 1999.

II. Scientific Personnel

Faculty: Lawrence Carin (PI)
Students: Priya K. Bharadwaj

III. Invention Reports

None

IV. Scientific Progress and Accomplishments

We have developed expansion matching (EXM) filters for various parts of a vehicle. Depending on whether the component is hot or cold, the corresponding IR imagery will be corresponding strong or weak. Therefore, the outputs of the sequence of EXM filters, for the different target parts, can be modeled as a hidden Markov tree, with each node of the tree corresponding to a particular EXM filter (part). Each node is modeled via a two-state model, with one corresponding to a strong component response, and the other a weak response. The different target parts constitute a given target, and therefore the probability of the various components being hot or cold is correlated, from part to part. This correlation is well modeled via a hidden Markov tree (HMT), with the state-transition probabilities between the different components capturing the underlying physics. The EXM-based HMT paradigm has been applied successfully to IR imagery from several military vehicles acquired from the Army Research Laboratory (Adelphi, MD). The data was generated by the Army NVESD.

V. Technology Transfer

The research reported here has been undertaken in close collaboration with the Army Research Laboratory (ARL), Adelphi, MD.